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Epidemiology of Infectious Meningitis

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INTRODUCTION

Nebraska Reportable Disease regulations require the reporting of persons infected with a variety of pathogens, many of which can cause rapid and devastating illness with the potential for spread among close personal contacts. Included in this group are pathogens causing non-viral infectious meningitis and bacteremias. This report addresses the occurrence of Nebraska residents infected with *Neisseria meningitidis* (NM), *Haemophilus influenza* (HI), Group B streptococcus (GBS) (*Streptococcus agalactiae*), and *Listeria monocytogenes* (LM) in whom the infecting organism was isolated from any normally sterile body site (e.g., cerebral spinal fluid [CSF], blood, joint or pleural fluid). In addition, this report addresses meningitis caused by all other non-viral infectious agents, including fungi, mycobacteria, and several bacterial pathogens.

For the four-year period from 1991 through 1994, public health authorities in Nebraska received and investigated reports on an average of 36 Nebraska residents per year (n=143) with either NM, HI, GBS, or LM isolated from CSF or other normally sterile body sites, or other non-viral pathogens isolated from CSF and causing meningitis. Table One shows the distribution of organisms classified by site of infection.

Table 1. Frequency of Isolation of Organism by Site of Positive Culture, Nebraska Reportable Disease Surveillance System, 1991-1994.

ORGANISM	CSF	BLOOD+CSF	BLOOD	OTHER	TOTAL
Neisseria meningitidis[1]	11	8	16	5	40
Haemophilus influenzae[1]	10	7	14	4	35
Group B streptococcus[1]	5	5	4	1	15
Listeria monocytogenes[1]	4	1	5	2	12
Streptococcus pneumoniae[2]	9	12	-	-	21
E. coli[2]	1	2	-	-	3
Staphylococcus aureus[2]	1	1	-	-	2

ORGANISM	CSF	BLOOD+CSF	BLOOD	OTHER	TOTAL
Klebsiella[2]	1	-	-	-	1
Enterobacter[2]	1	-	-	-	1
Group D strep-enterococcus[2]	1	-	-	-	1
Other strep[2]	2	-	-	-	2
Cryptococcus[2]	6	-	-	-	6
Gram+ cocci[2]	1	-	-	-	2
Tuberculous[2]	-	-	-	1	1
Etiology unknown[2,3]	-	-	-	2	1
Total	53	36	39	15	143

[1]Includes reports of isolates from normally sterile body sites.
[2]Includes reports of isolates from cerebrospinal fluid only.
[3]Reported by the physician as bacterial meningitis but unable to identify a causative agent by culture or gram stain; may have been partially treated at the time of spinal tap.

1. Meningococcal Disease

Nebraska averaged 10 persons with invasive meningococcal disease per year for the four-year period from 1991-1994 (n=40), with no indication of an increase in the frequency of the disease in the population over this period, no reported outbreaks, and no remarkable regional variation in incidence across the state. The Nebraska annual incidence rate of 0.62 per 100,000 is lower than the estimated 1/100,000 incidence rate for the country as a whole.

While the disease can occur throughout the year, both Nebraska and national data indicate a slightly higher frequency of meningococcal disease in the months of January, February, and March (Table 2).

TABLE 2.
DISTRIBUTION OF NEISSERIA MENINGITIDIS BY MONTH AND YEAR,
NEBRASKA, 1991-1994

Month	Year				
	91	92	93	94	total
January	1	2	1	3	7
February	2	0	1	0	3
March	0	1	0	2	3

April	1	2	1	1	5
May	0	1	1	1	3
June	3	0	2	0	5
July	0	0	2	0	2
August	0	1	1	0	2
September	1	2	0	1	4
October	0	1	0	2	3
November	0	0	0	1	1
December	0	1	1	0	2
Total	8	11	10	11	40

Approximately half (19/40) of the persons with meningococcal infection had meningitis with demonstrated positive cultures from CSF (Table 1). Of the 40 reported cases, laboratories performed serogrouping on 23 (58%). Of the 23 isolates for which the serogroup was known, 13 (57%) were Group B, 5 (22%) were Group C, 3 (13%) were group Y, and 2 (9%) were not groupable (Table 3). Although the numbers are small, there did not appear to be a shift in the serogroup distribution over this four-year period. While all age groups are susceptible to meningococcal disease, infants experienced a disproportionate amount of this disease compared to other age groups (Table 4).

TABLE 3. SEROGROUP DISTRIBUTION FOR N. MENINGITIDIS ISOLATES WITH KNOWN SEROGROUP, NEBRASKA, 1991-1994 (n=23)

Serogroup	Year				
	91	92	93	94	total
Serogroup B	3	3	3	4	13
Serogroup C	0	2	2	1	5
Serogroup Y	0	0	1	2	3
not groupable	0	0	0	2	2
unknown	-	-	-	-	17
Total	3	5	6	9	40

Table 4.
Distribution of selected types of bacterial meningitis or infection of other normally sterile body site, by age, Nebraska, 1991-1994

Species	Age Group (years)						
	<1	1-5	6-20	21-40	41-70	>70	total

N. mening	9	3	9	12	3	4	40
H. flu	14	6	1	5	4	5	35
group B strep	8	0	3	0	4	0	15
Listeria	0	0	2	2	3	5	12
Strep Pneumo	4	3	1	4	6	3	21
Total	35	12	16	23	20	17	123

Other parts of the United States and Canada have witnessed notable changes in the epidemiology of this disease, including:

1) An overall increase in the incidence rate of meningococcal illness. In Oregon the rate increased from 2.2/100,000 in 1992 to 4.6/100,000 in 1994, mostly due to an increase of a particular strain of Group B ("ET-5 complex") meningococcus.

2) An increase in the percent of illness caused by Group B meningococcal organisms.

3) An increase in the frequency of serogroup C meningococcal outbreaks, resulting in large increases in the use of meningococcal vaccine, which protects against disease caused by serogroups A, C, Y, and W-135.

The NDOH and other public health agencies continue to maintain close surveillance of meningococcal disease. Hospitals, laboratories and physicians should report occurrences of this illness to the state or a local health department. In addition, laboratories should forward a sample of the microbiologic culture to the NDOH laboratory for confirmatory serotyping, antibiotic sensibility testing, and banking. These steps will insure early detection of outbreaks and changes in the epidemiology of this potentially lethal infection.

2. *Haemophilus influenza*

In the early 1980s this organism caused devastating infections in infants and children, with morbidity and mortality equivalent to that of the polio epidemics of the early 1950s. A vaccine for children over 24 months of age, effective against *Haemophilus influenza* type B (HIB), was first introduced in mid-1985. Beginning late in 1987 several vaccines for children less than 2 years old were introduced.

While some debate exists as to how much disease reduction was directly attributable to these vaccines, following their introduction a marked reduction of pediatric HI invasive disease in Nebraska and across the country occurred. While data on the number of Nebraskans with reported HI invasive disease prior to 1991 are not available, more recent data show that the Nebraska population has participated in the near-elimination of this disease over the past few years. Between 1991 and November, 1995, the NDOH received reports of a total of 38 persons with invasive HI disease. Nebraska recorded successive declines in reported invasive HI for each of the past three years (Table 5), with most of the decline occurring in infants and children at whom the HIB vaccine is targeted.

Table 5. Invasive H flu infection by age group, Nebraska, 1991-Nov, 1995.

Age Group	Year					
	91	92	93	94	95	total
<1	9	3	2	0	1	15
1-5	3	3	0	0	0	6
6-20	0	0	0	1	1	2
21-40	2	1	2	0	0	5
41-70	1	1	1	1	1	5
>70	1	1	1	2	0	5
total	16	9	6	4	3	38

For the 23 months between January, 1994 and November, 1995, only two children under 10 years of age developed HI invasive disease in Nebraska. One was a six-month old who developed HI meningitis without having received an antecedent HIB vaccine. The other was an eight-year old with a chronic pulmonary illness who had been appropriately vaccinated at two years of age, and six years later developed HI pneumonia. The serotypes of the HI isolated from these two children are unknown.

The NDOH continues to maintain an aggressive surveillance program for persons who develop invasive infection from HI. Laboratories and physicians should continue to report such persons to their local health department, or to the NDOH when no local health department is available. Laboratories should forward a sample of the HI isolate to the NDOH laboratory for serotyping and banking.

3. Pneumococcal Meningitis

Nebraska has averaged approximately five persons with reported pneumococcal meningitis per year over the past five years, with no seasonal variation, no change in the frequency of disease over this time period, and no remarkable geographic variations in the rate of disease around the state. The NDOH requests that laboratories forward pneumococcal isolates from the CSF to the NDOH for studies on antibiotic resistance and serotyping.

4. Group B Streptococcus

Since 1984 the Nebraska Reportable Disease regulations have required the reporting of Group B streptococcus (*Streptococcus agalactiae*) infections where the organism is isolated from any normally sterile body site. Between 1991 and 1994 the NDOH received 15 such reports, eight of which were in children under a year of age. Infants, and particularly neonates, are at particularly high risk for GBS infections, usually as a result of acquisition of the organism at delivery during passage through the birth canal. A Centers for Disease Control active surveillance project found total and white incidence rates of 1.7 and 1.3 per 1,000, respectively, in infants less than 90 days of age. Applying these rates to the Nebraska population, 36 reports of invasive GBS disease in infants would be expected annually in comparison to the average of four infants reported in each of the past four years. For adults, studies in other populations have found annual incidence rates of around 3.6 per 100,000 per year, while Nebraska's annual rate for adults between 1991 and 1994 was 0.08 per 100,000. Physicians, hospitals and laboratories are most likely substantially under reporting patients with this disease.

5. *Listeria monocytogenes*

Neonates, immunocompromised individuals and pregnant women are at increased risk of infection with LM. The organism, which is widespread in nature, causes meningitis, sepsis, and stillbirths. Over the past ten years the United States has experienced several food-borne outbreaks of listeriosis caused by a variety of vehicles, including cheese, undercooked poultry, and non-reheated hot dogs. For the three-year period 1992-94 the NDOH received reports of 12 persons with infections where LM was isolated from a normally sterile body site, for an average annual incidence rate of 0.25/100,000. A 1995 CDC study which relied on several active surveillance initiatives in diverse populations found the rate of listeriosis to

have dropped from 0.79/100,000 in 1989 to 0.44/100,000 in 1992 and 1993, possibly as a result of improved food safety practices adopted by the food industry.

The age of the 12 Nebraska patients ranged from 17 years to 85 years. Two of these cases (16.7 %) occurred in children (seven and eight years of age), two (16.7 %) occurred in women of childbearing age (29 and 33), and the remaining eight (66.7 %) occurred in persons over the age of 60. A fetal death occurred as a consequence of infection in a 33 year-old female during the 16th week of pregnancy. There were no remarkable geographic or secular trends in the 12 reported patients, nor were any of the cases linked by an association with an identifiable common source.

Physicians and laboratories who identify patients with this infection should report the event to their local health department or to the NDOH when no local health department is available.

6. Other Pathogens

Over the past four years, the NDOH received reports of non-viral infectious meningitis caused by a wide range of other pathogens, with no remarkable geographic or temporal clustering. These reports appear to reflect the endemic occurrence of these illnesses in the population. Among this group, cryptococcal infections were most frequently reported. The occurrence of this illness is closely associated with the immune status of an individual. All such patients reported to the Nebraska Reportable Disease Surveillance System had identifiable immune system deficits, such as the Acquired Immunodeficiency Syndrome.

CONCLUSION

The group of infections addressed in this report are among the most severe and rapidly fatal diseases facing Nebraska health care providers and their patients. Because of their severe morbidity and mortality, and the propensity for many of these infections to spread within a community, public health authorities in Nebraska have prioritized the surveillance and follow-up of persons contracting this group of infections. The experience of other states demonstrates the utility of accurately defining their epidemiology in a population. Laboratory personnel and physicians are responsible for contacting public health personnel within 24 hours of identifying infections caused by these pathogens. Microbiologic isolates should be forwarded

to the NDOH laboratory for typing studies and to be banked for future reference. To request assistance in addressing the public health issues surrounding these infections, please use the following numbers. In Douglas County, contact the Douglas County Health Department at 444-7214. In Lancaster County, contact the Lincoln-Lancaster County Health Department at 441-8053. Elsewhere in the state, contact the NDOH at 402-471-2937.